# MIEP

MODELING IMMUNITY TO ENTERIC PATHOGENS
Modeling Mucosal Immunity
Summer School & Symposium

PROGRAM
Summer School in
Computational Immunology

The Virginia Bioinformatics Institute (VBI) at Virginia Tech is proud to be hosting this year's Modeling Mucosal Immunity (MMI) Summer School Program and Symposium on **June 9th-13th, 2014.** The program is sponsored by VBI's Center for Modeling Immunity to Enteric Pathogens (MIEP) and is intended for experimental immunologists who wish to gain or expand their understanding of the computational modeling tools used to study immune responses.

"Mathematical and computational models cannot replace experimentation, but they can provide a framework for organizing existing data, generating novel mechanistic hypotheses, and deciding where to focus key validation experiments in time and space. MIEP has built new types of mathematical and computational models that reveal novel mechanisms of immune regulation in the gut mucosa during enteric infection. The MMI Summer School and Symposium will provide a window into such promising computational modeling approaches. Participants will learn how they can use these tools for their own experiments and bring their studies to the next level," said Dr. Josep Bassaganya-Riera, Professor of Immunology at VBI and Director of MIEP.

In addition to experimental immunologists, computational biology and bioinformatics graduate students at the earliest stages of their studies are also welcome to attend the Summer School. No previous computational modeling experience is required.
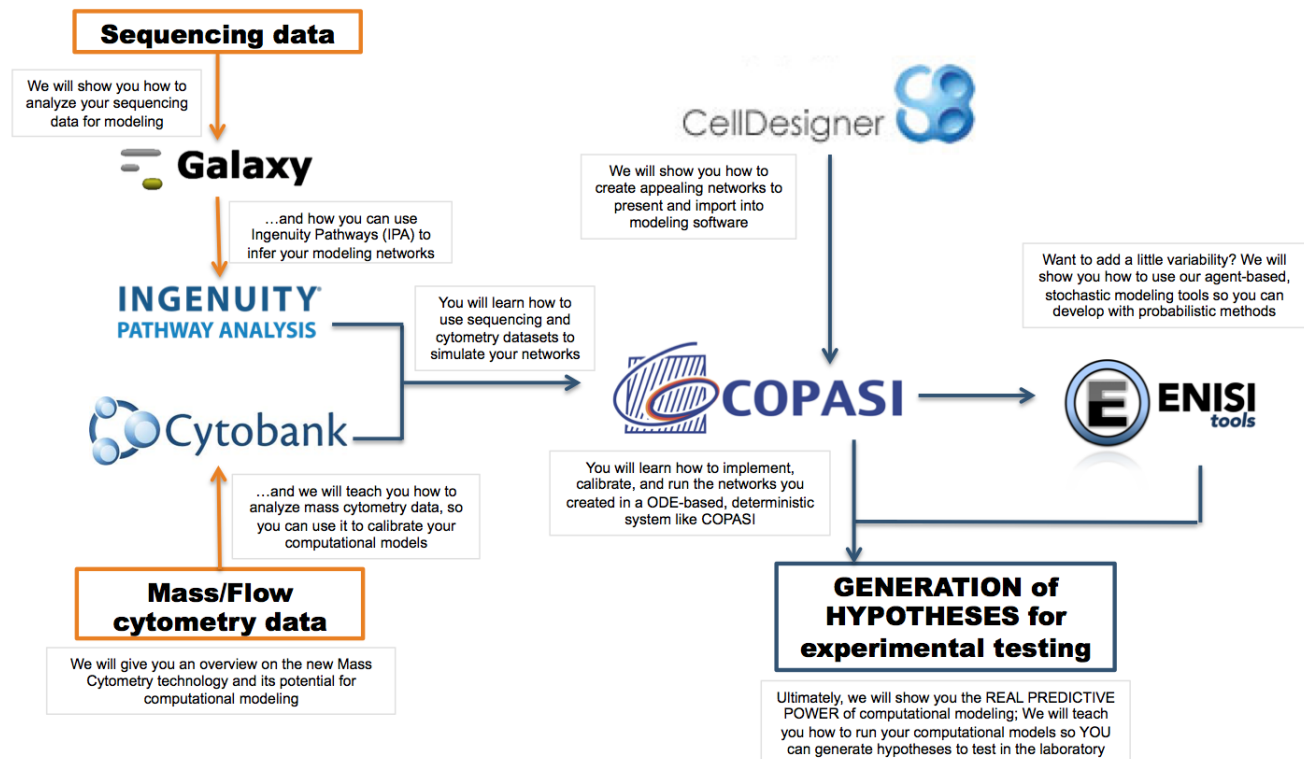
Is there anything you don't quite understand? Don't worry! The summer school will be an excellent opportunity for you to learn how to create **data-driven**, **predictive**, and **comprehensive** computational models. You will be able to network, meet, and collaborate with colleagues with a background in immunology and an interest in computational immunology as well!

SCHEDULE

Sunday 8th
Welcome and Installation Gathering
On Sunday, we will host a session in Newman Library to help set up your computer with our university high-speed WiFi connection and the software you will need during the summer school. Come and meet your fellow summer school participants!

Monday 9th
COPASI: Computational model creation and simulation
Monday will be centered on the process of model creation and deterministic simulations with ordinary differential equations (ODE). We will create a network from scratch, import it into COPASI, our modeling software, and run simulations to generate hypotheses. We will use our CD4+ T cell differentiation computational model as an example, which will be extensively discussed and presented in the morning.

Time	Speaker	Topic	Location
8.00-8.45AM		Registration; Meet&Greet	Kelly Hall Atrium
8.45-9.00AM	Dr. Josep Bassaganya-Riera	Welcome Remarks and Introduction to the Summer School	Kelly Hall RM 310
9.00-9.30AM	Dr. David Bevan	Introduction to Computational Modeling	Kelly Hall RM 310
9.30-10.45AM	Dr. Ken Oestreich	CD4+ T cell differentiation: An experimental view	Kelly Hall RM 310
10.45-11.15AM		Coffee Break	Kelly Hall Atrium
11.15-12.00AM	Adria Carbo	Systems Modeling of the process of CD4+ T cell differentiation	Kelly Hall RM 310
12.00-1.15PM		Lunch	
1.15-2.15PM	Dr. Stefan Hoops	Introduction to CellDesigner and COPASI	SCALE-UP Classroom
2.15-5.00PM	Dr. Stefan Hoops Adria Carbo Casandra Philipson Monica Viladomiu Pinyi Lu Tricity Andrew	Cell Designer and COPASI Hands-On Tutorials: i. 3-node T helper type 1 model ii. 9-node Th1, Th17 and iTreg model iii. Full CD4+ T cell differentiation model	SCALE-UP Classroom
5.15-7.00PM		Welcome Reception	

Welcome Reception

After the first day, we will host a Welcome Reception in the Old Dominion Room in Squires Center, at Virginia Tech. Enjoy this networking event with the rest of the instructors and other colleagues to share your interests and questions of the first day!

Tuesday 10th

The ENteric Immune SImulator (ENISI) and Cytobank: continuing with the modeling process

Tuesday will be centered on ENISI, our agent-based modeling tool and how to use different forms of this software. You will also learn how to use Cytobank, a software that analyzes mass cytometry data, and that will help you to generate calibration datasets for modeling purposes.

Time	Speaker	Topic	Location
8.00-8.45AM		Coffee	Kelly Hall Atrium
8.45-9.45AM	Dr. Madhav Marathe	The use of ENISI in the context of ABM and high-performance computing	Kelly Hall RM 310
9.45-10.30AM	Adria Carbo	Predictive Modeling of the immune responses towards *Helicobacter pylori*	Kelly Hall RM 310
10.30-11.00AM		Coffee Break	Kelly Hall Atrium
11.00-11.45AM	Dr. Yongguo Mei	The ENISI tool package	Kelly Hall RM 310
11.45-1.15PM		Lunch	
1.15-2.15PM	Dr. Yongguo Mei Adria Carbo	Hands-On Tutorial of ENISI tools package	SCALE-UP Classroom
2.15-2.45PM	Dr. Clare Rogers	Mass cytometry: a powerful technology to generate data for computational modeling	SCALE-UP Classroom
2.45-3.00PM		Coffee Break	SCALE-UP Classroom
3.00-4.30PM	Dr. T. J. Chen	Cytobank Hands-On Tutorial	SCALE-UP Classroom
4.30-5.00PM	Adria Carbo	Linking CyTOF to Computational Modeling	SCALE-UP Classroom

Wednesday 11th

Computational strategies for Network Inference and Modeling

On Wednesday, we will explore how to analyze RNAseq data and how to use the processed dataset to generate modeling calibration data. We will also show you how to incorporate RNAseq data into IPA, a software used for network inference.

Time	Speaker	Topic	Location
8.00-8.45AM		Coffee	Kelly Hall Atrium
8.45-9.45AM	Dr. Nir Yosef	Reconstructing the Th17 differentiation network: from profiles to drug targets	Kelly Hall RM 310
9.45-10.30AM	Dr. Coy Allen	Epithelial cells and their role in immunity	Kelly Hall RM 310
10.30-11.00AM		Coffee Break	Kelly Hall Atrium
11.00-11.45AM	Casandra Philipson	Modeling epithelial cell responses	Kelly Hall RM 310
11.45-1.15PM		Lunch	
1.15-2.00PM	Dr. Pawel Michalak	Overview on how to analyze RNAseq data with Galaxy	SCALE-UP Classroom
2.00-4.00PM	Dr. Kate Wendelsdorf	Ingenuity Pathways: a modeling strategy for network inference	SCALE-UP Classroom
4.00-5.00PM	Dr. Kate Wendelsdorf Casandra Philipson	Connecting Ingenuity Pathways to Computational Modeling	SCALE-UP Classroom

Thursday 12th
Multiscale Modeling: concepts, techniques, and applications

Thursday morning will focus on the concepts, techniques and applications of multiscale modeling. Speakers from the symposium will be present to discuss the latest advances in multiscale modeling. The afternoon will showcase how to integrate all the concepts learned during the summer school to create computational models and generate hypotheses.

Time	Speaker	Topic	Location
8.00-8.45AM		Coffee	SCALE-UP Classroom
8.45-9.30AM	Dr. Martin Meier-Schellerscheim	The multiscalability concept: working across scales to increase predictability	SCALE-UP Classroom
9.30-10.15AM	Dr. Josep Bassaganya-Riera	Connecting modeling approaches with experimental strategies	SCALE-UP Classroom
10.15-10.45AM		Coffee Break	SCALE-UP Classroom
10.45-12.00AM	MSM faculty*	Multiscale Modeling Roundtable	SCALE-UP Classroom
12.00-1.30PM		Lunch	
1.30-3.30PM	Adria Carbo Casandra Philipson	Integration of calibration data, network inference, and computational simulations	SCALE-UP Classroom
3.30-4.00PM		Poster set up	Owens Banquet Hall
4.00-7.00PM		Final Reception and Poster Session	SCALE-UP Classroom

MSM Faculty

To discuss the latest advances in multiscale modeling and debate what the user can do to apply it, we will have a multiscale modeling panel consisting of:

- Dr. Josep Bassaganya-Riera (Virginia Tech) *Moderator
- Dr. Martin Meier-Schellerscheim (National Institutes of Health, NIH)
- Dr. Nir Yosef (University of California Berkeley)
- Dr. Stuart Sealfon (Mount Sinai Hospital)
- Dr. Doug Lauffenburger (Massachusets Institute of Technology, MIT)
- Dr. Madhav Marathe (Virginia Tech)

Final Reception & Poster Session

To celebrate the end of the Summer School, as we transition to the Modeling Immunity Symposium, we will be holding a Poster Session in Owens Banquet Hall. This will be a great opportunity for networking and discussion as we learn a little more about the research being performed by other participants of the school. Refreshments will be provided.

**in alphabetical order

Dr. Coy Allen
Dr. Allen is an Assistant Professor at the Biomedical Sciences and Pathobiology Department at VMRCVM. His research interests are epithelial cell immunology, host pathogen interactions, and animal models of innate immunity and also allergic disease.

Dr. Josep Bassaganya-Riera
Dr. Bassaganya-Riera directs the Nutritional Immunology and Molecular Medicine Laboratory and is a Professor of Immunology at Virginia Tech. He is the Director of the Modeling Immunity to Enteric Pathogens (MIEP) that investigates the immunoregulatory mechanisms underlying host responses to gut pathogens by applying mathematical systems to mucosal immunology.

Dr. David Bevan
Dr. Bevan is the Education Lead in the Modeling Immunity to Enteric Pathogens Center. He is also a Professor at Virginia Tech and his laboratory applies computational molecular modeling to relate the structure and dynamics of molecular systems to function.

Adria Carbo
Adria is a senior Ph.D. Candidate in the Nutritional Immunology and Molecular Medicine Laboratory. He has been working with the Center for Modeling Immunity to Enteric Pathogens since 2010 and leads the efforts on the CD4+ T cell differentiation modeling.

Dr. Raquel Hontecillas
Dr. Hontecillas is the co-director in the Nutritional Immunology and Molecular Medicine Laboratory and the Immunology Lead and co-director in the Modeling Immunity to Enteric Pathogens Center, where she investigates the immunomodulatory mechanisms of action during *Helicobacter pylori*, *Clostridium difficile,* and *Escherichia coli* infection.

Dr. Stefan Hoops
Dr. Hoops is a Bioinformatician at the Nutritional Immunology and Molecular Medicine Laboratory and the developer of COPASI. His research interests are modeling and simulation of biochemical systems as well as management and analysis of systems biology data sets.

Dr. Doug Lauffenburger
Dr. Lauffenburger is a Professor of biological and chemical engineering at the Massachussets Institute of Technology (MIT). He also serves as the Head in the department of Biological Engineering. His research focuses on elucidating important aspects of receptor-mediated regulation of mammalian blood and tissue cell behavioral functions such as proliferation, adhesion, migration, and macromolecular transport.

Dr. Madhav Marathe
Dr. Marathe is the deputy director in the Network Dynamics and Simulation Science Laboratory (NDSSL) at Virginia Tech. He is also the lead in the Modeling Core in the Center for Modeling Immunity to Enteric Pathogens and his research interests are High-Performance Computing (HPC), linked to Agent-Based Modeling (ABM) in the context of infectious diseases.

Dr. Yongguo Mei
Dr. Mei is a Senior Software Engineer and Research Scientist at the Modeling Immunity to Enteric Pathogens Center. His interests are developing user-friendly modeling tools for the study of the immune responses to certain pathogens. He is one of the key developers of the ENISI agent-based modeling tool.

Dr. Ken Oestreich
Dr. Oestreich is an Assistant Professor at the Virginia Tech Carilion Research Institute and at the Biomedical Sciences and Pathobiology Department at VMRCVM. His laboratory focuses on defining the mechanisms by which transcription factors contribute to cellular differentiation and function in the immune system.

Casandra Philipson
Casandra is a Ph.D. student in the Nutritional Immunology and Molecular Medicine Laboratory. Her research involves elucidating the immune mechanisms of action towards infection with *Escherichia coli*. Furthermore, she has been working on computational models of epithelial cell response.

Dr. Stuart Sealfon
Dr. Sealfon is a neurologist at the Mount Sinai Hospital in New York and a Professor of Neurology, Pharmacology and Systems Therapeutics, and Neuroscience. He also serves as a chair in the Neurology department. Furthermore, he directs the Program for Research on Immune Modeling and Experimentation (PRIME). His research seeks to develop easy-to-use, predictive mathematical models to better understand patterns of infection among individuals affected by the flu virus.

Monica Viladomiu
Monica is a Ph.D. candidate in the Nutritional Immunology and Molecular Medicine Laboratory. Her research is centered on understanding the mechanisms of action towards infection with *Clostridium difficile*. Her research also involves the analysis of RNA sequencing data with Galaxy.

Dr. Katherine Wendelsdorf
Dr. Wendelsdorf is a scientist at Ingenuity Pathways (IPA) with a focus on the use of modern software for network inference and analysis. Her modeling background was centered on analyzing large gene expression data sets to identify discrete response states of immune cells. Dr. Wendelsdorf received her Doctorate from Virginia Tech and is a former Ph.D. student in the Modeling Immunity to Enteric Pathogens Center.

Dr. Nir Yosef
Dr. Yosef is an Assistant Professor at the Department of Electrical Engineering and Computer Science and a member of the Center for Computational Biology at UC Berkeley. The goal of his research is to utilize high-throughput genomic data sets in order to build models that explain how gene expression is regulated.
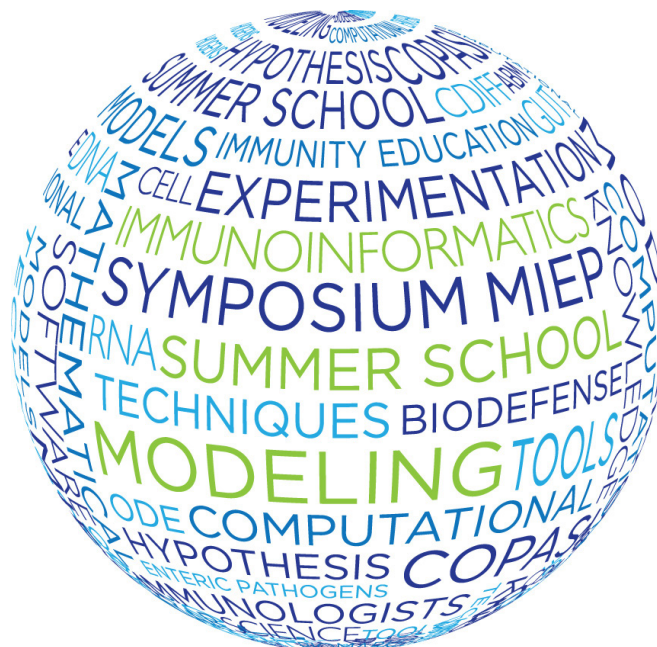
TRAVEL AWARDS

Interested in the MIEP Modeling Mucosal Immunity Summer School Travel Award to attend the Summer School and Symposium in June?

Travel Awards Web Release Date: December 10th, 2013
Applications Due Date: April 10th, 2014
Awards Announced: April 15th, 2014

Requirements
Students, faculty and staff from academia and the private sector are eligible for this award, with preference for students and postdocs. To be eligible, applicants must submit a 400 words abstract as first-author for a poster presentation during the Symposium. Awards will NOT be given to individuals who are not themselves presenting, even if their name(s) appear as a co-author of the work.

The MIEP Modeling Mucosal Immunity Summer School Travel Award will cover:

Transportation to and from Blacksburg, VA, up to a maximum of $800

Refreshments, receptions, and selected lunches

Hotel accommodations (double occupancy) for the entire stay in Blacksburg

Want to apply? Please click HERE or visit www.modelingimmunity/education/student-travel-awards

More Information
www.modelingimmunity.org/education/
email: summerschool@vbi.vt.edu

Dr. David Bevan
drbevan@vt.edu
540-231-5040

Dr. Josep Bassaganya-Riera
jbassaga@vbi.vt.edu
540-231-7421

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